THE SUGARY ADDED FOOD AND BEVERAGES CONSUMPTION AND ITS ASSOCIATION WITH THE NUTRITIONAL STATUS OF CHILDREN AGE 10-11 YEARS OLD IN KOTA BHARU, KELANTAN

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by

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CERTIFICATE

This is to certify that the dissertation entitled **"THE SUGARY ADDED FOOD AND BEVERAGES CONSUMPTION AND ITS ASSOCIATION WITH THE NUTRITIONAL STATUS OF CHILDREN AGE 10-11 YEARS OLD IN KOTA BHARU, KELANTAN"** is the bona fide record of research work done by **MISS WAN NOOR NAJIHAH BINTI WAN MAHMOOD** during the period from September 2016 to May 2017 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfillment for the degree of Bachelor of Health Science (Honours) (Nutrition).

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

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Date:

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
FFQ	Food Frequency Questionnaire
WHO	World Health Organization
SSB	Sugar Sweetened Beverages
RTEBC	Ready-to-Eat Breakfast Cereals
BAZ	Body Mass Index for Age
EDS	Energy- Dense Snack
MANS	Malaysian Adult Nutrition Survey
NHMS III	Third National Health and Morbidity Survey
HSSF	High Fat, Sugar and Salt Food
SSSDs	Sugar Sweetened Soft Drink

PENGAMBILAN GULA TAMBAHAN DALAM MAKANAN DAN MINUMAN DAN PERHUBUNGANNYA DENGAN STATUS PEMAKANAN KANAK-KANAK BERUMUR 10-11 TAHUN DI KOTA BHARU, KELANTAN

ABSTRAK

Kajian ini bertujuan untuk menilai hubungkait antara pengambilan makanan dan minuman bergula dengan status pemakanan (indek jisim tubuh (BMI) terhadap umur dan tinggi terhadap umur) dalam kalangan kanak-kanak berumur 10-11 tahun. Seramai 180 kanak-kanak berumur 10-11 tahun yang bersekolah di sekolah rendah di Kota Bharu telah terlibat dalam kajian rentas ini. Pengambilan makanan diukur menggunakan borang kekerapan pengambilan makanan (FFQ). Pengukuran antropometri dilakukan untuk mengira indeks jisim tubuh kanak-kanak dan borang sosio-demografik telah dijawab oleh ibu bapa. Hasil kajian menunjukkan kebanyakan ibu bapa bekerja dengan majikan dan mempunyai pendidikan tertinggi di peringkat sekolah menegah. Lebih daripada separuh (50.5%) pelajar berasal daripada keluarga yang mempunyai saiz isi rumah antara 6-8 orang. Kebanyakan isi rumah mempunyai pendapatan lebih daripada RM3500 sebulan. Kebanyakan isi rumah juga berada dalam kumpulan yang membelanjakan lebih daripada RM750 sebulan untuk makanan. Berdasarkan skor kekerapan pengambilan makanan, kebanyakan makanan dan minuman manis diambil dalam jumlah/skor sederhana (30.0-79.9) dan hanya aiskrim berada dalam kategori pengambilan banyak (80.0-100.0). Berkenaan status pemakanan, lebih dari separuh (55.6%) kanak-kanak adalah normal

BMI diikuti kurus (12.8%), terlebih berat badan dan obes (12.2% masing-masing) dan sangat kurus (7.2%). Kebanyakan (82.8%) pelajar mempunyai tinggi terhadap umur yang normal, manakala 14.4% dan 2.8% selebihnya adalah terbantut dan terbantut teruk. Satu-satunya makanan yang mempunyai perkaitan dengan status pemakanan (indek jisim tubuh terhadap umur) iaitu air sirap (χ^2 = 6.119, p = 0.045). Tiada perkaitan antara pengambilan makanan dan minuman bergula dengan tinggi terhadap umur dikesan. Kesimpulannya, terdapat perkaitan yang signifikan antara air sirap dengan status pemakanan (BMI terhadap umur).

THE SUGARY ADDED FOOD AND BEVERAGES CONSUMPTION AND ITS ASSOCIATION WITH THE NUTRITIONAL STATUS OF CHILDREN AGE 10-11 YEARS OLD IN KOTA BHARU, KELANTAN

ABSTRACT

This study aims to determine the association between the sugary added food and beverages consumption with the nutritional status (BMI-for-age and height-for-age) among children age 10-11 years old. A total of 180 children aged 10- 11 years old attending primary school in Kota Bharu were included in this cross-sectional study. The food intake was assessed by using Food Frequency Questionnaire (FFQ). Anthropometric measurements were conducted in order to calculate the BMI of the children and the sociodemographic questionnaires were answered by parents. The sociodemographic profile showed most of the parents were employed and the highest prevalence of educational level was secondary school. More than half (50.5%) of the students came from the family with the household size between 6-8 people. Most of the household were in the category of which had salary more than RM3500 per month. Most of the household were in the category of which spending more than RM750 per month on food. According to food frequency score, most of the food and drinks were consumed moderately (30.0-79.9 score) and only ice cream was in the category of mostly consumed food (80.0-100.0 score). More than half (55.6%) of the children had normal BMI, followed by thinnest (12.8%), overweight and obese (12.2% respectively) and severe thinnest (7.2%). Besides,

most (82.8%) of the students also have normal height-for-age while 14.4% and 2.8% of them were stunted and severely stunted. The only food items associated with the nutritional status (BMI-for-age) was “sirap drink” ($\chi^2 = 6.119$, $p = 0.045$). No association between sugary added food and beverages consumption with height-for-age was found. There is a significant relationship between sugary added food and beverages consumption of “air sirap” and nutritional status (BMI-for-age).

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The term ‘added sugars’ is defined by The American Heart Association (AHA) as the sugars and syrup that are added to foods during the processing, preparation and to the serving (Amarra *et al*., 2016). The World Health Organization (WHO) uses the term “free sugar” in their sugar recommendations instead of “added sugar” (World Health Organization, 2015). In order to guide the consumers in recognizing the beverages and foods that are high in added sugars, the “added sugar” term is used by 2000 Dietary Guidelines for Americans (Erickson and Slavin, 2015).

Malaysian Adults Nutrition Survey (MANS) mentioned that the top 10 daily consumed food and beverages among all ethnicities including the local dessert such as ‘kuih’ that is highly-sweetened food, cordial, chocolate-flavoured drink, coffee and tea (Norimah *et al*., 2008). The average sugar intake of 10 teaspoons of sugar in drinks per day among Malaysians is above WHO recommendations and this is a worrying trend because about 30% of children are overweight or obese due to increase intake of sugary foods, not to mention tooth decay (Muhammad Yazid, 2011). About 55.3% of total added sugar intake by adult are contributed by self-prepared drinks (35%), non-carbonated soft drinks (11.7%) and carbonated soft drinks (8.6%). (Nik Shanita *et al*., 2012).

Even though the added sugars are not chemically different from naturally occurring sugars, many foods and beverages that are major sources of added sugars provide lower micronutrient densities compared to foods and beverages that are major sources of naturally occurring sugars (Erickson and Slavin, 2015). Hess *et al.* (2012) stated that over-consumption of foods with high added sugars may replace more nutrient-

dense foods which may contribute to over-consumption of calories or nutrient deficiencies. The sugar sweetened beverages (SSB) are known as food that are worthless of minerals and vitamins and add calories to the diet (Fernandes, 2008; Naska *et al.*, 2010).

The negative impact on diet quality (not meeting the Dietary Reference Intakes (DRI) for nutrients) among children and adolescents of U.S. is demonstrated by sugars, sugar-sweetened beverages, and sweetened grains sweets (Frary *et al.*, 2004). The consumption of added sugar contribute to approximately 20% of total energy intake among adolescent (20.4% males and 20.1% females) and to nearly 19% among children aged 6 to 11 years old in the United States (Guthrie & Morton, 2000). The Food groups such as biscuits and crackers, chocolate and confectionary, snack bar, cakes and buns, dessert, and sweet spread contribute to 43.7% of total energy intake by Australian children age 5-16 years old (Bell & Swinburn, 2004).

The sugar-sweetened beverages become popular among the children because of the sweet taste, clear and attractive colour and is associated with overweight because liquid sugars do not bring the sense of satiety, so the consumption of other foods is not reduced (de Ruyter *et al*., 2012). As the beverages do not bring to a sense of satiety, they are considered to put on weight than solid foods (Mattes, 2006). The higher intakes of liquid carbohydrates may lead to weight gain because of lack of dietary compensation of liquid carbohydrate compared with dietary compensation of comparable amounts of solid carbohydrate (DiMeglio, & Mattes, 2000).

Increase the prevalence of children's obesity as a major health problem (Olds *et al*., 2011; Ogden *et al*., 2012) coexist with a great increase in the consumption of sugar-sweetened beverages (Duffey and Popkin, 2007). According to Verloigne *et al.* (2012), the obesity among children aged 10-12 years old in Europe is contributed by over

consumption of energy dense foods that are low in nutritional quality. A study done by Malik *et al*. (2010) and Stanhope (2012) suggest that the glucose rises dietary glycaemic load, while fructose elevating visceral adiposity and contribute to metabolic complications.

According to Drewnowski (2000), children's preferences for sweet and energy dense food were well developed when they attending school. The children are likely to consume sugary snack and fatty foods compared to nutritious options (Bell & Swinburn, 2004). A wide range of the fatty lunches, sugary soft drinks, and fast-food items that are common in schools become the indicator for the obesity epidemic in United States (Schmunk, 2010).

In America, the fourth-grade children consumed fewer healthy foods (fruits, vegetables, and milk) but more sweetened drinks (Cullen & Zakeri, 2004). Borradaile *et al.* (2009) mentioned in their study that, sugar-sweetened beverages accounted for 88% of all beverages purchased among school students, meanwhile candy recorded for 21.3% as the second most frequently purchased items/ foods at school. A study by Sanigorski *et al*. (2007) revealed that, Australian children who usually consumed fruit juice/drinks twice or more per day were 1.7 times to be overweight/obese as compared with those who consumed once or less per week.

In America, added sugar especially has been indicated as a major cause of several chronic diseases prevalent including obesity, diabetes, heart disease and dental caries (Welsh and Cunningham, 2011). The rationale to establish the added sugar recommendations that aimed to lower the total calories is driven by a reliance that the foods which are high in added sugars contribute to empty calories and low nutrient density (Erickson and Slavin, 2015). It was recommended that, the intake of sugary food and

drink should be limited to maximum 4 times per day while the consumption of added sugar supposedly remains below 10% of energy intake (Petersen, 2003).

1.2 Problem Statement

Even though the school children has shown an improvement in nutritional over the past decade, Malaysia still facing the double burden of malnutrition that is indicated by both underweight and overweight (Ahmad Ali *et al.*, 2013). The rapid changes in health related problem and disease around the world are closely related to the change in lifestyle which includes the diet rich in sugar, the widespread use of tobacco and the consumption of alcoholic drink with the addition to socio-environmental determinant (Petersen, 2003).

In Malaysia, the food group contribution to added sugar intake by the population showed the percentage of added sugar intake for biscuit and breakfast cereal was 7.2%, 5.8% for sweet and chocolate, 5.4% cake and variation, 5.3% bun and dumpling, 2.9% ice cream and variation (Nik Shanita *et al.*, 2012). The top 10 consumed foods by adult who live in the urban areas including sugar (51.4%), sweetened condensed milk (34.9%), bread (19.6%) and biscuits (14.7%) (Norimah *et al.*, 2008). The study by Zainal Badari *et al*. (2012) show that, the households consumed sweetened condensed milk and powdered milk as sources of calcium in their food intakes.

The sweet snacks and desserts known as kuih had been mentioned as the top 10 daily consumed foods among all ethnicity in Malaysia (Sharifah Azizah *et al.*, 2015). Among the top 10 food items consumed, commercial and traditional "kuih" reported to contribute to added sugar intake of 8.1% among Klang Valley population (Nik Shanita *et al.*, 2012). The majority of free sugars consumed by pre-schoolers had exceeded the

recommendation proposed by WHO (not more than three times a day) (Zahara *et al.*, 2010).

Between 1989 and 2008, intake of sugar-sweetened beverages among 6-11 year olds children had increased (from 130 to 212 kcal/day), while intake of milk and 100% fruit/vegetable juice declined (from 210 to 133 kcal/day) (Lasater *et al.*, 2011). When children progressed from childhood to early adolescence, both prevalence and frequency of soft drink intakes more than tripled while the intake of milk and fruit juice decreased (Lytle *et al.*, 2000). Mean intakes of total added sugar of children aged 6 to 11 years old increase when consuming sweetened dairy products and presweetened cereals (Frary *et al*., 2004).

The most popular beverages purchased among students grades 4 through 6 is artificially flavoured "fruit" drinks that accounted for 45.7%, from half of all the beverage purchases among school student (Borradaile *et al*., 2009). Study by Bell and Swinburn (2004) mentioned that, cordial/ fruit drinks were controversial as almost 8% of total energy intake at school were contribute by this type of drinks and this is much higher when compared with 3.1% of total energy intake among 2- 18 year olds population in US. Calories contribution from 55% to 70% and 7% to 15% of all sugar-sweetened beverage on a typical weekday were consumed in the home environment and in schools respectively (Wang *et al*., 2008).

Ludwig *et al*. (2001) stated that consumption of sugar-sweetened drinks among children in primary school increased as well as the prevalence of obesity in children. *Mrdjenovic and Levitsky (2003)* mentioned that, US children aged 6–13 years old who attend a summer camp and those who consumed >16 ounce/day of sugar-sweetened soft drinks had significantly higher total energy intake and susceptible to greater weight gain compared to those who consumed between 6oz and 16oz per day. Besides, Qi *et al*. (2012)

suggest that the persons with a genetic liability to obesity are especially vulnerable to the effects of sugar-sweetened beverages on Body Mass Index (BMI).

According to Vartanian *et al.* (2007), there is a clear association between the consumption of soft drinks by children with the increased in energy intake and body weight. The study by Bes-Rastrollo *et al.* (2006) had observed an association between the weight gain and the increase in the consumption of sugar-sweetened soft drinks (SSSDs) after a 28.5-months follow-up in Mediterranean population. Woodward-Lopez *et al*. (2011) estimated that at least one-fifth of the weight is gained by US population in year 1977 until 2007 due to the sweetened beverages.

The prevalence of obesity among 11-13 years old children in California were significantly associated with the number of soft drinks consumed (Giammattei *et al.*, 2003). This is indicated by those consuming 3 or more soft drinks per day has higher mean (SE) BMI *z* score (1.02 [0.13]; $P = 0.003$) compared to those who drinks less than 3 soft drinks per day (0.51 [0.07]). A study by Novotny *et al.* (2004) among adolescent girl showed a 0.005 kg increase in weight was associated with a 1 gram increase in soda consumption (or a 341.6 gram can of soda with a 1.7 kg increase in weight).

Also, an analysis of cohort studies suggests a positive connection between the level of free sugars intake and dental caries in children (World Health Organization, 2015). Continuous sipping sugared beverage and holding them in the oral cavity for a prolonged period increases the risk of caries (Touger-Decker and Van Loveren, 2003). Children age 2-11 years old who drink about medium to high amounts of sugar-sweetened beverages and soft drink were associated with greater energy intakes and lower consumption of fruit and vegetable (Ogata & Hayes, 2014).

1.3 Significance of the study

The findings of this study may useful in identifying which types of food and beverages that are commonly consumed by the children. Also, the outcomes may helpful in determine the association between sugary added foods and beverages consumption and nutritional status among primary school children. The findings from the study can be used by the ministry of education to conduct health promotion and health education to the school children in order to increase their awareness of the importance of restriction of sugary foods and beverages intake. The information and findings from the study also can be used for future research.

1.4 Study Objectives

1.4.1 General

To investigate the sugary added foods and beverages consumption and its association with nutritional status among children age 10 to 11 years old in Kota Bharu.

1.4.2 Specific

1. To determine the frequency of sugary added foods and beverages consumption among children age 10 to 11 years old in Kota Bharu.

2. To determine the nutritional status (BMI-for-age and height-for-age) of 10 to 11 years old children in Kota Bharu.

3. To investigate the relationship between the sugary added foods and beverages consumption and its effect on nutritional status (BMI-for-age and height-for-age) among 10 to 11 years old children in Kota Bharu.

1.5 Hypothesis

Null Hypothesis: There is no significant relationship between the sugary added food and beverage consumption and its effect on nutritional status (BMI-for-age and height-for-age) of 10 to 11 years old children in Kota Bharu.

Alternative Hypothesis: There is a significant relationship between sugary added foods and beverages consumption and its effect on nutritional status (BMI-for-age and height-for-age) of 10 to 11 years old children in Kota Bharu.

1.6 Conceptual Framework

The conceptual framework guiding this research is based on the association between the sugary foods and beverages consumption on the nutritional status of children aged 10-11 years old. Figure 1.1 shows the factor that may influence the nutritional status of children. The socioeconomic status (income), sociodemographic factor (age, gender, and race) and environmental factor (peer influence, obesogenic environment) influenced children to consume sugary added food and beverages thus would influence their nutritional status.

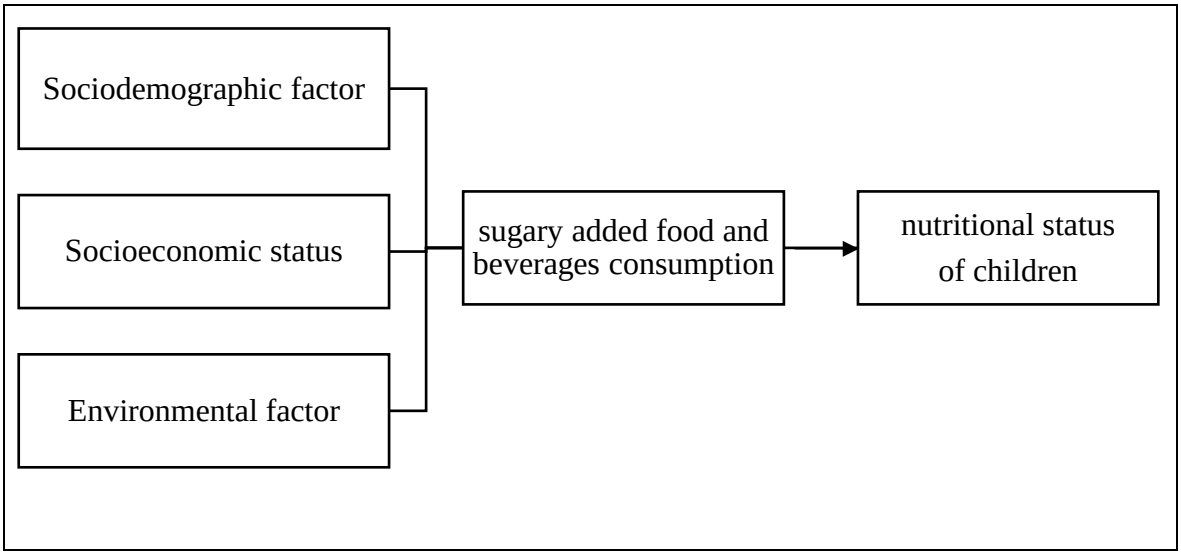

Figure 1.1: Factors that influence the nutritional status of children

CHAPTER 2

LITERATURE REVIEW

The literature review focus on the definition of added sugar, the prevalence of sugary added food and beverages consumption in worldwide and Malaysia, factors influencing the consumption of sugary added food and beverages, consequence of sugary added food and beverages consumption, the prevalence of nutritional status among primary school children in worldwide and Malaysia and the association of sugary added food and beverages with the nutritional status.

2.1 Added Sugar

WHO (2015) defined the "free sugars" as monosaccharides (glucose and fructose) and disaccharides (sucrose or table sugar) added to foods and drinks during manufacturing, cooking or naturally sugars present in fruit juices, honey, syrups and fruit juice concentrates. According to Ruiz *et al.* (2017), the free sugars are similar to added sugars as the free sugar also included syrups and sugars added to foods. While the naturally occurring sugar lactose, especially in milk and dairy product or fructose in fruit were not included as added sugar (Johnson and Yon, 2010).

The commonly used added sugar in food preparation including sweeteners, jam, and table sugar while the commercially processed food products contained added sugar were carbonated drinks, cordials, biscuits, breakfast cereals, cakes, pastries and buns (Nik Shanita *et al*., 2012). Sugar, sweets and soft drinks are more likely to give a negative impact on diet quality, whereas dairy foods, milk drinks, and presweetened cereals may have a contrasting impact (Johnson *et al.,* 2009). The sugar-sweetened beverages have low glycemic index and low satiety index but higher in energy content, which caused increased food intake after their ingestion (Raben *et al*., 2002; Mourao *et al*., 2007).

2.2 Sugary added Food and Beverages Consumption in Worldwide

National Cancer Institute (2016) revealed that the sugar-sweetened carbonated beverages/ energy/ sports drinks as the primary source of added sugars in Americans' diets. While, the top five sources of added sugars children and adolescent in U.S. are the fruit drinks, grain-based desserts, dairy desserts, candy and ready-to-eat cereals (National Cancer Institute, 2016). The common snacking pattern of miscellaneous snacks (17%), cakes/cookies/pastries (12%) and sweets (9%) were demonstrated by the adult who participated in the National Health and Nutrition Examination Survey (NHANES) 2001-2008 (Nicklas *et al.*, 2014).

In the US, between years 1994 until 1996, the soft drinks consumption provide over 5% of total energy intake among 2-18 years old population (Nielsen & Popkin, 2004). Frary *et al.* (2004) conclude that the increase intakes of sugars, sugar-sweetened beverages, sweets, and sweetened grains increased the total added sugars in children age 6-11 years old and 12-17 years old. The greatest percentage of added sugars in American's diet is contributed by non-diet soft drinks that accounted around 22% for children ages 6-11years old and 37% and 41% for females and males adolescent respectively (Guthrie & Morton, 2000).

The combination of soda and fruit drinks as sugar-sweetened beverages (SSB) contributed for 45% to 50% of added sugars among nearly all demographic groups and age (Kavey, 2010). The overall prevalence of soft drink consumption among school-aged children was higher in 1994/1998 (56%) compared to the overall prevalence in 1977/1978 (37%) (French *et al*., 2003). According to Grimm *et al.* (2004), children aged 12-13 years old consumed higher soft drinks everyday as compared to children aged 10-11 years old and 8-9 years old (38.7%, 31.7%, and 17.7% respectively).

Grimm *et al*. (2004) mentioned about 30% of the children consumed soda on a daily basis and over 18% consumed less than 1 time/week or never. About 10% to 11% of the total energy intake is obtained by youth who consumed carbonated soft drinks (French *et al.,* 2003). However, a study by Rajeshwari *et al.* (2005) revealed the percentage of children who consume sweetened beverages show a significant ($P < 0.05$) decreased from 83% in 1973 to 81% in 1994 especially the intake of coffee with sugar and soft drinks.

The total energy consumption for 2-18 years old children in the form of empty calories contributed to nearly 40% of total energy intake (798 kcal/day) was indicated by 433 kcal from solid fat and 365 kcal from added sugars (Reedy and Krebs-Smith, 2010). While study by Beck *et al*. (2013) concluded that the percentage of California children intake SSB among children aged 2 to 5 years old declined from 40% in 2003 to 16% in 2009 whereas among children aged 6 to 11 years old, the percentage decline from 54% in 2003 to 33% in 2009.

Sugar-sweetened beverage (SSB) consumption by middle-income and low-income countries showed three-fifths of SBB intake comes from soft drinks, fruit drinks, cordials, energy drinks and flavoured milk (Basu *et al.,* 2013). The main contributor of added sugar intakes among children and teenagers from Ireland showed to be the carbonated beverages, cordials and squashes, followed by confectionery, biscuits, cakes, buns, pastries and ready-to-eat breakfast cereal (RTEBC) (Joyce *et al*., 2008). Twenty percent of total energy intake among children age 5–14 years old in New Zealand was indicated by the high fat, sugar, and salt (HFSS) foods and drinks that replaced the healthier foods in their diet (Ministry of Health, 2012).

A study by Clifton *et al.* (2011) revealed that the mean intake of soft drink among Australian children aged 2-16 years old was 436mL/day. In 2010, the average

consumption of sugar-sweetened beverages were 0.58 (8 ounces servings/day) while the mean consumption of fruit juice and milk were 0.16 and 0.57 serving/day respectively (Singh *et al.*, 2015). Overall 14.9% of primary school children reported drinking at least one SSB per day while the remaining 85.1% consumed less than one SSB per day (Lebel *et al*., 2016).

2.3 Sugary added Food and Beverages Consumption in Malaysia

In Malaysia, the highest intake of added sugar in daily diet was demonstrated by Malay ethnic group (54.0 ± 19.9 g/ day) followed by Indian (44.4 ± 17.4 g/day) and the lowest intake was reported by Chinese who consumed about 29.8 ± 15.4 g/day of added sugar (Nik Shanita *et al*., 2012). The average SSB consumption by children age 13 years old was 0.71 servings/day (177.5mLdaily) with the highest consumption was noted among Malays ($190mLday^{-1}$) followed by Indians and Chinese ($138mLday^{-1}$ and $110mLday^{-1}$, respectively) (Loh *et al*., 2016). While Norimah *et al.* (2008) mentioned the sweetened condensed milk, powdered milk, bread, biscuits and local "kuih" were on the top 10 daily consumed foods among adults aged 18 to 59 years old in Malaysia.

Study by Zahara *et al*. (2010) among pre-schooler showed that more than one-third (40%) of the children consumed sugary food for twice a day in which 38.1% of them were girls and 41.4% were boys followed by the consumption of once a day (27.6% of boys and 33.3% girls). Only 9 (31%) boys and 6 (28.6%) girls consumed sugary food more than three times a day (Zahara *et al.*, 2010). The mean frequency consumption of beverages daily by population showed that, the most frequent consumed beverages is plain water with majority of them drank it for at least six times daily followed by the

intake of tea, coffee, chocolate-flavoured drink, and cordial with an average consumption between 1.8 times to 1.4 times daily (Norimah *et al.*, 2008).

Norimah *et al.* (2008) reported that the consumption of soft drinks or carbonated drinks was not in the top frequently consumed drink by population every day. The frequency of sugary drink intake by pre-schooler showed that almost half of them (46%) consumed sugary drink more than three times a day with 57.1% of them are girls and 37.9% are boys also almost one-third of the children drank as much as once a day (Zahara *et al.*, 2010). About 59% of sugar consumed was added to beverages such as chocolate-based drinks, coffee and tea (Norimah *et al.*, 2008).

2.4 Factors Influencing the Consumption of Sugary Added Food and Beverages

Results from the study by Grimm *et al.* (2004) suggested that the notably taste preferences, availability of soft drink in the home and school, parents and friends habit of soft drink intake and television viewing are the factors that related to consumption of soft drink in school-aged children. The convenient of sugary drinks, biscuits, sweets and cakes that require small or no cooking at all are appealing to parents and caregivers from cooking traditional home meals (Ministry of Health, 2012).

The association between family socioeconomic status (good compared with poor and average) showed the significant odds ratios varied between 2.9 and 20.2 for soft drinks and between 1.8 and 5.6 for sweets (Touger-Decker & Van Loveren, 2003). Higher socio-economic status groups and urban residents mostly preferred and consumed easily available and commercialized sugar product (Jamel *et al.*, 1996). It is difficult to limit the consumption of these foods because they are widely available, cheap and are all over in

markets which bring to the perception that they are affordable and can be eaten every day (Ministry of Health, 2012).

More frequent consumption of soft drink and higher availability of soft drinks in the household were associated with lower socio-economic status (Naska *et al*., 2010). This is supported by Han and Powell (2013) who concluded that a higher odds of heavy total SSB consumption (odds ratio 1.93) and higher energy intake from total SSBs and fruit drinks was reported among low-income children had than high-income children. However, consumption of added sugar and fat were higher in people of higher income nations than do people in lower income countries (Drewnowski, 2003).

As mentioned by Liem and De Graaf (2004), the early exposure to sugar sweetened items contributed to higher levels of sugar in foods and increased in preference for sweetened items. The consumption of added sugar decreased after adolescence and was further reduced during adult life (Drewnowski *et al*., 2012). Conversely, older revealed to consume higher sugar-sweetened carbonated beverage (SSCB) and sugar-sweetened hot beverages than younger children (Collison *et al*., 2010). However, Han and Powell (2013) reported that the heavy SSB consumption (≥500 kcal/day) increased in children aged 2-11 years old (4% to 5%) but decreased in adolescents aged 12-19 years old (22% to 16%).

According to Berkey *et al.* (2004), the higher beverage intake (apple juice, orange juice and soda drink) was demonstrated among boys aged 10-11 years old compared to girls at the same age. The mean intake of sugar-sweetened beverage servings per day is higher among boys (1.33±1.34) than girl (1.08±1.20) (Wiecha *et al*., 2006). Also, the weekly consumption of SSCB and fruit juice among boys aged 10-13years old were slightly higher (6.39 and 3.76 respectively) compared to girls (6.02 and 3.75) (Collison *et al*., 2010).

The consumption of added sugar was higher in younger subjects and Malay ethnic group reported as the highest consumers of added sugar in the daily diet, followed by Indian and Chinese (Nik Shanita *et al*., 2012). In line with this, study by Loh *et al*. (2016) mentioned the sugar-sweetened beverages intake was highest among Malay and the least intake was noted by Chinese. Highest mean consumption of sugar-sweetened beverage servings per day from vending machine was demonstrated by African American (2.08±1.75), followed by Hispanic (1.49±1.70), White (1.16±1.21), and Asian or others (1.01±1.15) (Wiecha *et al*., 2006).

According to Naska *et al*. (2010), the consumption of soft drink were probably being shaped by the advertisement, the availability of vending machines in working places and schools, and the insufficient promotion of healthy food choices to the population. The ethnicity, socioeconomic characteristics and family's cultural influenced what foods were on the family table that could influenced the children's early food preferences and intake patterns (Anzman *et al*., 2010).

Based on study by Han and Powell (2013), adolescents with lower educational level of parents tend to have higher odds of heavy total SSB consumption (odds ratio 1.28) and higher energy intake from total soda and SSBs (by 21 and 27 kcal/day). In study by Johnson *et al*. (2007), children of certificate of secondary education (CSE) mothers had higher consumption of SSB than children of degree-educated mothers but the consumption of fruit juice is higher among children of degree-educated mothers than children of CSE mother.

2.5 The Consequence of Sugary Added Food and Beverages Consumption

Bray and Popkin (2014) argue on the several health problems associated with sugar-sweetened beverages and have effects beyond the calories they add to the diet. However, Slavin (2014) suggested that the added sugars are not causing weight gain compared to any other calorie source as added sugar also provide 4 kcal/g just like any other digestible carbohydrate. Erickson and Slavin (2015) stated that added sugar intake is not uniquely linked to negative health outcomes or chronic diseases unlike sodium or dietary fiber that have clear links to health outcomes.

The tooth decay in Yup'ik children aged 6 to 17 years old showed a significant and positive association with the added sugar consumption as assessed by hair biomarker (Chi *et al*., 2015). Touger-Decker and Van Loveren (2003) mentioned about the direct relationship between dental caries across the life span with the consumption of dietary sugars. Also, there is a negative effect on the intakes of fruit and vegetables and micronutrients among children and adolescents when the intake of added sugar is higher (Øverby *et al*., 2004).

2.6 The Nutritional Status of Children in Worldwide

In all developed countries, the body weight gain is increasing across all age groups (St-Onge *et al*., 2003). Obesity posing an alarming problem and was described as an "escalating global epidemic" as it virtually affecting both developed and developing countries regardless of all socioeconomic groups including all age groups (World Health Organization, 2000). Segal and Sanchez **(**2001) mentioned that obese children are likelihood to develop into obese adults.

In the United States, the increase in overweight and obesity rates were socially and environmentally related and the higher risk can be seen in low-income communities (Hofferth and Curtin, 2005). In 2009-2010, 16.9% of US children and adolescents (age 2-19 years old) were obese but no difference in the prevalence of obesity is detected among males or females (Ogden *et al.*, 2012). The data from the National Health and Nutrition Examination Survey (NHANES) in the US reported that 16.9% of children and adolescents had a BMI of 95th percentile in the year 2007- 2008 (Ogden *et al.*, 2010).

The number of European Union children who are overweight is expected to increase by 1.3 million children each year and without urgent action to prevent this trend, more than 300,000 of them will become obese each year (Wang and Lobstein, 2006). According to New Zealand Health Survey 2006/07, 21 % of children and young people aged 2–14 years old were overweight and further 8 % were obese (Ministry of Health, 2012). Among Asia country, the prevalence of overweight among Singaporean children aged 10-12 years old was about 22.5% while north-eastern part of Thailand recorded around 7.9% of urban school children aged 7–9 years were overweight (Langendijk *et al.*, 2003; Sabanayagam *et al.*, 2009).

Indonesia reported that the prevalence of overweight among 8-10 years old children from the urban area was 17.8% in boys and 15.3% in girls (Soekirman *et al.*, 2002). The major public health problem in developing countries is indicated by children malnutrition (Ahmad Ali *et al.*, 2013). A study by Srivastava *et al. (*2012) in India showed the prevalence of wasting was highest in the age group 5 to 7 years old whereas the prevalence of stunting and underweight was highest in the age group 11 to 13 years old.

2.7 The Nutritional Status of Children in Malaysia

Positive transition of economic in Malaysia has led to lifestyle with "Westernization" style that then leads to a rapid increase in incidence and prevalence and of obesity in this country (Vikneswaran *et al.,* 2015). UNICEF (2016) mentioned Malaysia as one of the ASEAN countries that had undergoes the double burden of malnutrition that was indicated by the condition where there was a simultaneous scenario of over and under-nutrition (some children were overweight while the others were suffering from wasting and stunting).

According to Anuar Zaini *et al.* (2005), the primary school children aged 9-10 years old revealed that the majority (76.2%) of them have normal BMI while 1.2% were underweight and the remaining 16.3% and 6.3% were overweight and obese. Study by Ahmad Ali *et al.* (2013) revealed that, school children in urban areas showed a higher prevalence of overweight based on body mass index for age (BAZ) at 12.5% and weight for age (WAZ) at 8.8% than students in rural areas (5.9% and 8.9%, respectively). The prevalence overweight and obese among children aged 13 years old revealed to be 19% and 15% (Loh *et al.,* 2016).

The study by Tee *et al.* (2002) revealed that the prevalence of underweight was higher among boys (7.7%) than girls (6.4%) as well as the higher prevalence of stunting can be seen among boys (7.9%) compared to girls (5.5%). While, standard 5 boys and girls (aged 11 years old) showed about a similar proportions of who were overweight (7.5% boys and 7.1% girls) whereas more boys were underweight (16.2%) as compared to girls (13.3%) (Ming Moy *et al.,* 2004). More than half (60.2%) of primary school children aged 8-12 years old in Kuala Lumpur have normal BMI-for-age while others were thinness/severe thinness (10.2%), overweight (13.1%) and obese (16.5%) (Yang *et al.,* 2017).

Overweight status also showed a significant (p<0.001) difference in the ethnic and gender (Nicklas *et al*., 2003). The overall prevalence of overweight among primary school children aged 7-12 years old in Malaysia was 19.9% and those who live in urban areas showed a higher prevalence of 22.6% and was significantly higher among boys (21.7%) (Naidu, *et al.,* 2013). Institute for Public Health (2015) also stated that higher prevalence of normal BMI for age can be seen among children who lived in rural areas (81.6%) as compared to children who reside in urban areas (79.8%).

National Health and Morbidity Survey 2015 revealed children aged 5-9 years old has the highest prevalence of obesity (14.8%) as compared to children aged 10-14 years old (14.4%) (Institute for Public Health, 2015). The standard 5 students revealed to have the highest prevalence of underweight (16.1%) as well as overweight (10.1%) compared to form 2 (15.1% and 5.6%) and form 4 students (12.8% and 5.7%) (Ming Moy *et al.,* 2004). According to Institute for Public Health (2015), the national prevalence of stunting by age group showed children below 5 years old has the highest prevalence of stunting (17.7%) while the lowest prevalence can be seen among children aged 10-14 years old (11.0%).

Compared to children who live in rural areas, children in the urban areas were slightly higher in prevalence of obesity (12.1% vs. 11.2%) and more distinct in boys (13.6%) than girls (10.0%) (Institute for Public Health, 2015). Anuar Zaini et *al.* (2005) found a significant ($p < 0.001$) difference in BMI between boys and girls, revealed that the boys were significantly heavier than the girls and there is also a significantly ($p \leq 0.003$) higher BMI of student from urban areas compared to their rural counterparts. By state, the highest prevalence of underweight in peninsular Malaysia was found in Pahang (17.1%) (Institute for Public Health (2015). In addition, the prevalence of stunting was

outstandingly higher among girls than boys (14.1% vs. 12.7%) and those who live in the rural areas as compared to urban area residents (16.8% vs. 12.1%).

Two surveys among primary school children conducted by Universiti Kebangsaan Malaysia (UKM) in the year 2001 and 2008 found that the prevalence of overweight and obesity had increased from 20·7 to 26·4 %, whereas the prevalence of thinness decreased from 9·7 to 9·5% (Ruzita *et al*., 2009). The prevalence of overweight and underweight among children were 13.23% and 5.36% respectively showing that the higher prevalence of overweight is among boys (Ministry of Health Malaysia 2006; Narayan and Abdul Rashid 2007; Norimah and Haja Mohaideen 2003). Poh *et al*. (2013) also reported that the prevalence of obesity (11·8 %) and overweight (9·8 %) were higher than thinness (5·4 %) and stunting (8·4 %) among children aged 6 months to 12 years old in Malaysia.

2.8 The Association of Sugary Added Food and Beverages with The Nutritional Status.

Finding from Ludwig *et al*. (2001) suggested that the intake of sugar-sweetened drink could be a crucial contributory factor for obesity epidemic although the causes of obesity were likely to be multifactorial. As mentioned by Reedy & Krebs-Smith (2010), the key contributor to empty calories and largest source of added sugar in American youth were sugar-sweetened drinks. For each additional can or glass of sugar-sweetened drink that the children consumed every day, the odds ratio for them to become obese increased by 1·6 times (Ludwig *et al.*, 2001).

The daily energy intake progressively increases with higher sugar intake (Mazlan *et al.,* 2006). The increase in consumption of calorie-sweetened beverages contributed to

the prevalence of obesity (Bray & Popkin, 2014). The study by Welsh et *al.* (2005) provides evidence that infrequent (1 to 2 times daily) of sweet drinks consumption had increased the remaining overweight for those who are already overweight by 60% or more and elevated the odds to be overweight among those who are at risk.

Te Morenga *et al.* (2013) and Tappy (2012) indicated that the increase in consumption of free sugar increase the energy intake as well as increase the body weight and body fat mass. Bray (2013) strongly indicated that the caloric load from sweetened foods and beverages contributed to obesity and these foods nevertheless lead to a corresponding reduction of other food consumption. However, Hein *et al.* (2005) summarized that there is no persuasive evidence that linked an obesity with the consumption of high-fructose corn syrup.

Rajeshwari *et al.* (2005) stated that children who were in the category of high intake of sweetened beverage have higher mean BMI (18.6 kg/m^2) compared to other groups (none, low and medium) with BMI of 18.0, 18.1 and 18.4 kg/m^2 respectively. Ludwig *et al.* (2001) also found that the odds ratio of becoming overweight among children aged 11 and 12 years old increased by 60% for each serving of sugar-sweetened drink consumed in a day. While a study by Sanigorski *et al*. (2007) revealed that children who consumed >2–3, >3–4 and >4 servings of fruit drinks/juice on the previous day showed to be 1.7 and 2.1 times of overweight/obese compared with those who do not consume any servings of fruit juice/drink.

There is an insignificant relationship between overweight among children and the consumption of sweet drinks (Rajeshwari *et al*., 2005; Forshee *et al*., 2004; Newby et al., 2004). According to Berkey *et al.* (2004), change in one serving/day of sugar-added beverage consumption was associated with the change in BMI among adolescent boys and girls (0.03 kg/m2 and 0.02 kg/m2 respectively). In contrast, result from a study by

Dubois *et al.* (2007) indicated that young children may be at greater risk for overweight with the frequent sugar-sweetened beverage consumption, specifically between meals.

A cluster-randomized controlled trial by James et al. (2004) revealed that decrease in the prevalence of overweight among children age 7-11 years old is indicated by a reduction in carbonated beverage intake. The logic states that if the added sugar consumption increases without compensation from other calorie sources, the calorie intake will also increase which may result in weight gain (Welsh and Cunningham, 2011). Kahn and Sievenpiper (2014) argue for no clear or convincing evidence that any dietary or added sugar has a detrimental or distinctive effect relative to any other source of calories on the development of obesity or diabetes.

Park *et al.* (2012) mentioned that after adjusting other factors, the weight status was not significantly associated with sugar-sweetened soda intake. This is support by Ranjit *et al*. (2010) and Weicha *et al.* (2006) who found no associations between BMI and sugar-sweetened drink intake among youth. However, Malik *et al*. (2013) and Pérez-Morales *et al*. (2013) suggested an association between SSB intake and weight status in children as the consumption of these beverages has been reported to cause weight and obesity.

Suggestion for adults and children to reduce their daily intake of free sugars to less than 10% of total energy intake and a further reduction to lower 5% (approximately 25 grams or 6 teaspoons) per day would provide additional health benefits (WHO, 2015). Strategy for the prevention and treatment of overweight adolescents seems to be promising when consumption of sugar-sweetened beverages decrease (Ebbeling *et al*., 2006). Most public health opinion leaders agree that added sugar should be consumed at a minimum to prevent excess intake of calories while taking in all necessary nutrients (Erickson and Slavin, 2015).

CHAPTER 3

METHODOLOGY

3.1 STUDY DESIGN

This cross-sectional study was conducted from January to April 2017 involving five systematically selected primary school in Kota Bharu, Kelantan.

3.2 POPULATION AND SAMPLE

3.2.1 Reference Population

The population was all children aged 10 to 11 years old who attended primary school in Kota Bharu, Kelantan.

3.2.2 Source Population

The participant were children aged 10 to 11 years old who were attending selected primary school in Kota Bharu, Kelantan. The schools involved in the study included Sekolah Kebangsaan Ismail Petra (1), Sekolah Kebangsaan Kubang Kerian (2), Sekolah Kebangsaan Lundang, Sekolah Kebangsaan Paloh Pintu Gang and Sekolah Kebangsaan Seri Cempaka.

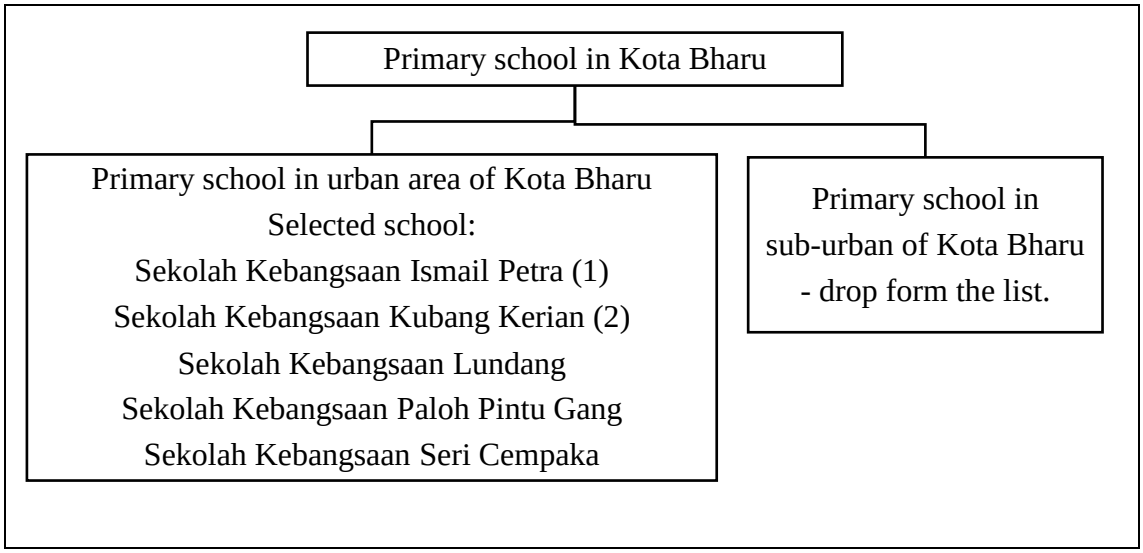

Figure 3.1: Selection of Primary School in Kota Bharu

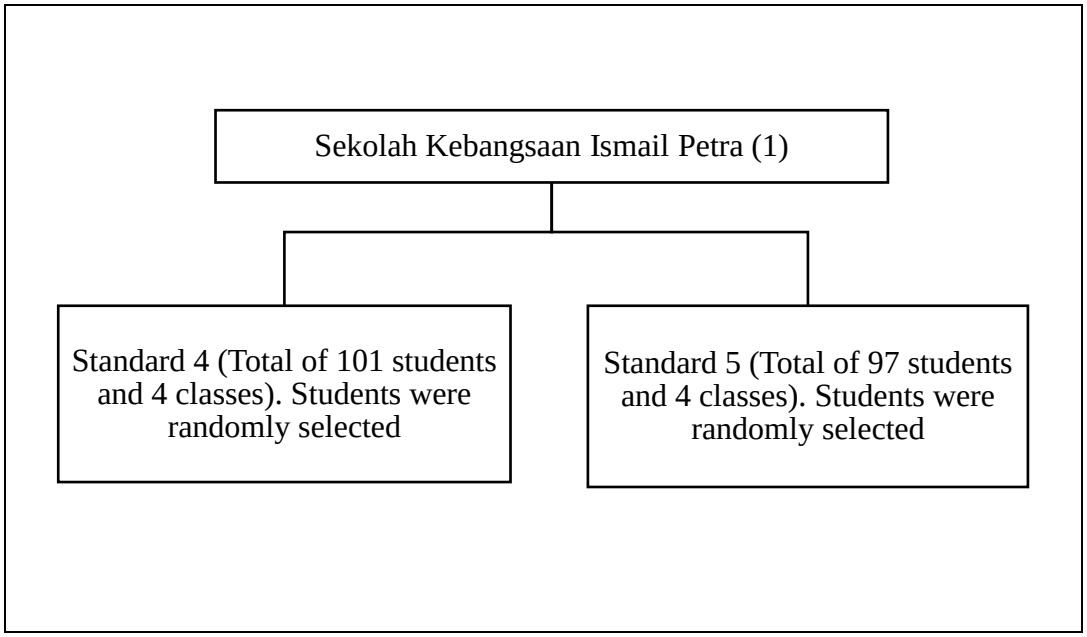

Figure 3.2: Students selection in Sekolah Kebangsaan Ismail Petra (1)

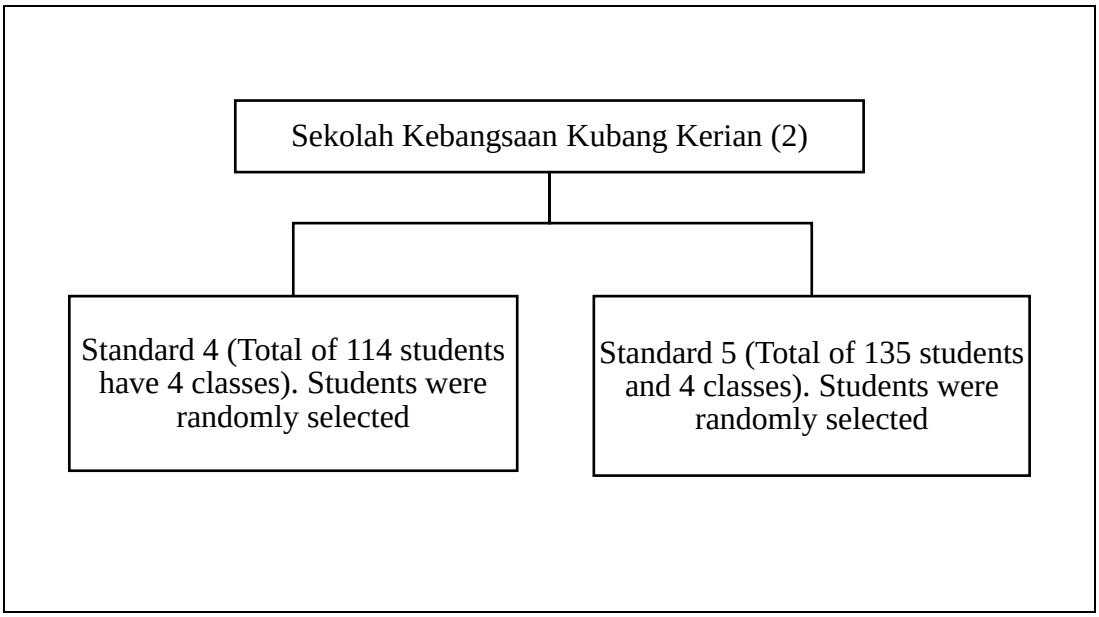

Figure 3.3: Students selection in Sekolah Kebangsaan Kubang Kerian (2)